

IN THE CLAIMS:

1. (Currently Amended) A work chucking/inserting apparatus for chucking a work, for aligning the work with an insertion hole and for inserting the work into the insertion hole, said apparatus comprising:

a pushing mechanism for pushing the work toward the insertion hole;

three or more chuck fingers,

said chuck fingers being arranged in circumferentially spaced positions around a central axis and slidably mounted for advancing and retreating radially in a linear line relative to said central axis,

inner surfaces of said chuck fingers serving as chuck surfaces for chucking the work, and outer surfaces of said chuck fingers being tapered at least at tip end portions thereof, tapering inward toward said central axis approaching the tips, for contact with an inlet of the insertion hole; and

drive means, comprising a motor, for advancing and retracting said chuck fingers radially in a linear line relative to said central axis and for controlling a chucking force exerted by said chuck fingers.

2. (Previously Presented) A work chucking/inserting apparatus for chucking a work, for aligning the work with an insertion hole and for inserting the work into the insertion hole, said apparatus comprising:

three or more chuck fingers,

said chuck fingers being arranged in circumferentially spaced positions around a central

axis and slidably mounted for advancing and retreating radially in a linear line relative to said central axis,

inner surfaces of said chuck fingers serving as chuck surfaces for chucking the work, and outer surfaces of said chuck fingers having at least at tip end portions thereof surfaces extending parallel to said central axis for contact with an inlet of the insertion hole; and tracer means for, when the outer surfaces of said chuck fingers come into contact with the inlet of the insertion hole, reorienting said apparatus to bring said central axis into alignment with a central axis of the insertion hole.

3. (Previously Presented) A work chucking/inserting apparatus for chucking a work, for aligning the work with an insertion hole and inserting the work into the insertion hole, said apparatus comprising:

three or more chuck fingers and three or more hole position detecting fingers, said chuck fingers being arranged in circumferentially spaced positions around a central axis and slidably mounted for advancing and retreating radially in a linear line relative to said central axis,

said hole position detecting fingers being arranged in circumferentially spaced positions and pivotable inwards and outwards relative to said central axis, about pivot points on base end portions thereof,

inner surfaces of said chuck fingers serving as chuck surfaces for chucking the work, and

outer surfaces of said hole position detecting fingers being tapered at least at tip end portions thereof, tapering inward toward said central axis approaching the tips, for contact with an inlet of the insertion hole; and

drive means for advancing and retracting said chuck fingers radially in a linear line relative to said central axis and for controlling a chucking force exerted by said chuck fingers.

4. (Original) A work chucking/inserting apparatus according to claim 3, wherein the base end portions of said hole position detecting fingers are pivotally connected to tip end portions of said chuck fingers.

5. (Previously Presented) A work chucking/inserting apparatus according to claim 3, wherein the base end portions of said hole position detecting fingers are pivotally connected to a base portion, said base portion supporting said chuck fingers for radial advance and retreat.

6. (Cancelled)

7. (Cancelled)

8. (Previously Presented) A work chucking/inserting apparatus according to claim 1, wherein the inlet of the insertion hole is chamfered, and the tip end portions of said chuck fingers are

respectively formed with projections which mate with the chamfered portion when the work is inserted into the insertion hole.

9. (Previously Presented) A work chucking/inserting apparatus according to claim 1, wherein the work is a piston or an assembly of a piston and a connecting rod, and the insertion hole is a cylinder bore.

10. (Previously Presented) A work chucking/inserting apparatus according to claim 3, wherein the work is an assembly of a piston and a connecting rod, the insertion hole is a cylinder bore, said chuck fingers chuck said piston, and said hole position detecting fingers also serve as means for chucking said connecting rod.

11. (Previously Presented) A work chucking/inserting apparatus for chucking a work, for aligning the work with an insertion hole and for inserting the work into the insertion hole, said apparatus comprising:

three or more chuck fingers,

said chuck fingers being arranged in circumferentially spaced positions around a central axis and slidably mounted for advancing and retreating radially in a linear line relative to said central axis,

inner surfaces of said chuck fingers serving as chuck surfaces for chucking the work and each having a portion tapering inward toward said central axis approaching a distal end thereof, outer surfaces of said chuck fingers being tapered at least at tip end portions thereof, tapering inward toward said central axis approaching the tips, for contact with an inlet of the insertion hole,

tracer means for, when the outer surfaces of said chuck fingers come into contact with the inlet of the insertion hole, reorienting said apparatus to bring said central axis into alignment with a central axis of the insertion hole, and

pushing means for pushing the work toward the insertion hole.

12. (Previously Presented) A work chucking/inserting apparatus according to claim 11, wherein the inlet of the insertion hole is chamfered, and the tips of the outer surfaces of said chuck fingers are shaped to mate with the chamfered portion when the work is inserted into the insertion hole.

13. (Previously Presented) A work chucking/inserting apparatus for chucking a work, for aligning the work with an insertion hole and for inserting the work into the insertion hole, the insertion hole having a chamfered inlet, said apparatus comprising:

three or more chuck fingers,

said chuck fingers being arranged in circumferentially spaced positions around a central

axis and slidably mounted for advancing and retreating radially,
inner surfaces of said chuck fingers serving as chuck surfaces for chucking the work and
each having a portion tapering inward toward said central axis approaching a distal end thereof,
end faces of said distal ends of said chuck fingers being at least partially flat for coming
into abutment against a wall surface which surrounds an inlet of the insertion hole,
projections depending from close to inner peripheral edges of the end faces of said chuck
fingers, each of said projections having an outer surface tapering inward toward said central axis
approaching a distal end thereof, for mating with the chamfered portion of the inlet of said
insertion hole when said work is inserted into said insertion hole,
tracer means for, when the outer surfaces of said projections come into contact with the
inlet of the insertion hole, reorienting said apparatus to bring said central axis into alignment with
a central axis of the insertion hole, and
pushing means for pushing said work toward the insertion hole.

14. (Previously Presented) A work chucking/inserting apparatus according to claim 11, wherein
the work is a piston or an assembly of a piston and a connecting rod, and the insertion hole is a
cylinder bore.

15. (Previously Presented) A work chucking/inserting apparatus according to claim 11, wherein

said pushing means includes a vacuum chuck for holding the work.

16. (Cancelled)

17. (Cancelled)

18. (Previously Presented) a work chucking/inserting apparatus according to claim 3 wherein said drive means comprises a motor.

19. (Currently Amended) A work chucking/inserting apparatus for chucking a work, for aligning the work with an insertion hole and for inserting the work into the insertion hole, said apparatus comprising:

a pushing mechanism for pushing the work toward the insertion hole;

three or more chuck fingers,

said chuck fingers being arranged in circumferentially spaced positions around a central axis and slidably mounted for advancing and retreating radially in a linear line relative to said central axis,

inner surfaces of said chuck fingers serving as chuck surfaces for chucking the work, and

outer surfaces of said chuck fingers being tapered at least at tip end portions thereof, tapering inward toward said central axis approaching the tips, for contact with an inlet of the

insertion hole; and

tracer means for, when the outer surfaces of said chuck fingers come into contact with the inlet of the insertion hole, reorienting said apparatus to bring said central axis into alignment with a central axis of the insertion hole.

20. (Currently Amended) A work chucking/inserting apparatus for chucking a work, for aligning the work with an insertion hole and for inserting the work into the insertion hole, said apparatus comprising:

a pushing mechanism for pushing the work toward the insertion hole;

three or more chuck fingers,

said chuck fingers being arranged in circumferentially spaced positions around a central axis and slidably mounted for advancing and retreating radially in a linear line relative to said central axis,

inner surfaces of said chuck fingers serving as chuck surfaces for chucking the work, and

outer surfaces of said chuck fingers having at least at tip end portions thereof surfaces extending parallel to said central axis for contact with an inlet of the insertion hole; and
drive means for advancing and retracting said chuck fingers radially in a linear line relative to said central axis and for controlling a chucking force exerted by said chuck fingers.

21. (Previously Presented) A work chucking/inserting apparatus for chucking a work, for aligning the work with an insertion hole and inserting the work into the insertion hole, said apparatus comprising:

three or more chuck fingers and three or more hole position detecting fingers,

said chuck fingers being arranged in circumferentially spaced positions around a central axis and slidably mounted for advancing and retreating radially in a linear line relative to said central axis,

said hole position detecting fingers being arranged in circumferentially spaced positions and pivotable inwards and outwards relative to said central axis, about pivot points on base end portions thereof,

inner surfaces of said chuck fingers serving as chuck surfaces for chucking the work, and outer surfaces of said hole position detecting fingers being tapered at least at tip end portions thereof, tapering inward toward said central axis approaching the tips, for contact with an inlet of the insertion hole; and

tracer means for, when the outer surfaces of said chuck fingers come into contact with the inlet of the insertion hole, reorienting said apparatus to bring said central axis into alignment with a central axis of the insertion hole.

22. (Previously Presented) A work chucking/inserting apparatus according to claim 21, wherein

the base end portions of said hole position detecting fingers are pivotally connected to the tip end portions of said chuck fingers.

23. (Previously Presented) A work chucking/inserting apparatus according to claim 21, wherein the base end portions of said hole position detecting fingers are pivotally connected to a base portion, said base portion supporting said chuck fingers for radial advance and retreat.

24. (Previously Presented) A work chucking/inserting apparatus according to claim 21, wherein the inlet of the insertion hole is chamfered, and the tips of the outer surfaces of said hole position detecting fingers are shaped to mate with the chamfered portion when the work is inserted into the insertion hole.

25. (Previously Presented) A work chucking/inserting apparatus for chucking a work, for aligning the work with an insertion hole and for inserting the work into the insertion hole, said apparatus comprising:

three or more chuck fingers,

said chuck fingers being arranged in circumferentially spaced positions around a central axis and slidably mounted for advancing and retreating radially in a linear line relative to said central axis,

inner surfaces of said chuck fingers serving as chuck surfaces for chucking the work, and outer surfaces of said chuck fingers being tapered at least at tip end portions thereof, tapering inward toward said central axis approaching the tips, for contact with an inlet of the insertion hole;

hole position detecting means for detecting the position of the insertion hole, said hole position detection means comprising a force sensor for detecting the magnitude and direction of a resultant force of reaction forces which said piston chuck fingers receive from the cylinder bore upon contact therewith.